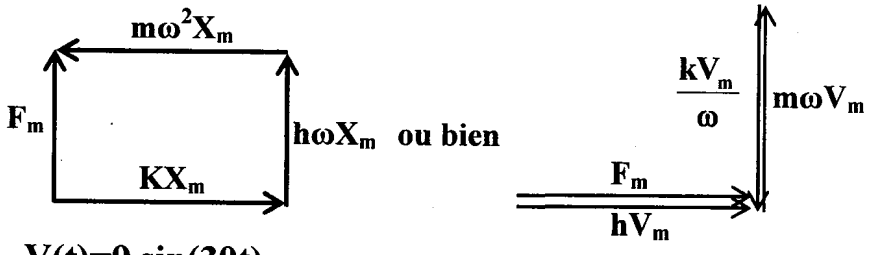
$$F_m = hv_m \rightarrow V_m = \frac{F_m}{h} = \frac{4,5}{0,5} = 9ms^{-1}$$

$$\varphi_F = \varphi_V \qquad \varphi_V = 0$$

$$\varphi_F - \varphi_x = \frac{\pi}{2}$$



V(t)=9.sin(30t)

$$x(t) = \int v dt = \frac{9}{30}\sin\left(30t - \frac{\pi}{2}\right) = 0,3\sin\left(30t - \frac{\pi}{2}\right)$$

4°)

a- $E = \frac{1}{2}mv^2 + \frac{1}{2}kx^2$

$$\frac{dE}{dt} = mva + kxv = v(ma + kx)$$

$$= v(F - hv)$$

$$F = F_m \sin(\omega t + \varphi_F)$$

$$hv = hV_m \sin(\omega t + \varphi_v)$$

$\omega = 40rads \neq \omega_0 \Rightarrow Fm \neq hv_m$ et $\varphi_F \neq \varphi_V$

$$F - hv \neq 0 \Rightarrow \frac{dE}{dt} \neq 0 \Rightarrow E \text{ varie}$$

$$\begin{cases} x = 0 \\ v = v_m = 2,47ms \end{cases} \Rightarrow E_1 = \frac{1}{2}mV_m^2 = 0,3J$$

$$\begin{cases} x = X_m = 6,18m \\ v = 0 \end{cases} \Rightarrow E_2 = \frac{1}{2}kv_m^2 = 0,17J$$

b-

$$\frac{dE}{dt} = v(F - hv)$$

$$\omega = \omega_0 = 30rads \quad \left.\begin{matrix} F_m = hv_m \\ \varphi_F = \varphi_V \end{matrix}\right) \Rightarrow F - hv = 0$$

$$\Rightarrow \frac{dE}{dt} = 0 \Rightarrow E = cte$$

$$\begin{cases} x = 0 \\ v = \pm V_n = \pm 9ms^{-1} \end{cases} \Rightarrow E = \frac{1}{2}mV_m^2 = 4,05J$$

Rq

$$F - hv = 0 \Rightarrow \underbrace{F + f = 0}_{\text{Equation différentielle}} \Rightarrow F = -f$$

La force excitatrice compense la force de frottement

$$ma + hv + kx = F \Rightarrow ma + kx = f - hv$$

$$\Rightarrow ma + kx = 0 \Rightarrow \frac{d^2x}{dt^2} + \frac{k}{m}x = 0$$